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18. PRELIMINARY OBSERVATIONS ON THE RELATIVE RESISTANCE OF SELECTED SPECIES OF INDIAN TIMBER TO GRIBBLE (*LIMNORIA*) ATTACK

(With a plate)

INTRODUCTION

Occurrence of the crustacean wood borer *Limnoria*, commonly known as Gribble, along the Indian coast was first reported by Palekar & Bal (1957), who collected a few specimens from timber panels immersed in Bombay harbour. They also noted that crustacean borers are not of any economic importance in the vicinity of Bombay harbour in view of their stray occurrence. The specimens collected by them were assigned to a new species, *Limnoria (Limnoria) bombayensis* (Pillai 1961). Becker (1959) collected two species, *L. indica* Kampf, & Becker and *L. tripunctata* Menzies from Madras and Mandapam. Five other species have been recorded from the Andaman Islands also (Bernard 1936; Ganapati & Rao 1960). Apart from these records no information is available either on their biology or on the damage caused by them to various species of Indian timber.

Several investigators have pointed out that no timber is resistant to *Limnoria* attack. Even green-heart (*Ocotea rodiaei*), considered highly resistant to marine wood borers, is not immune to the attack of *Limnoria* (Stevenson 1874; Edmondson 1955:29). Moreover no poison is known that is really effective against them and it is found that creosote treatment merely retards and does not prevent *Limnoria* attack. It is reported that *Limnoria* attacks even timber which is impregnated with corrosive sublimate (Mullins & Mullins 1848).

During October-November 1964, a sudden outbreak of damage by *Limnoria (Limnoria) bombayensis* was noticed on the experimental timber panels immersed in the Bombay harbour and since then they were found to have done considerable damage to the panels of some

of the timber species (see plate). Details on the incidence of *Limnoria* on various species of Indian timber tested are given in the present paper.

MATERIALS AND METHODS

In the present study 25 timber species, belonging to 14 families, were tested in two series in Bombay harbour under the Mazagaon Pier. The experimental site is well under tidal influence and during extreme low tide the panels are exposed to the atmosphere for two to three hours. Moreover, the sea bottom in the area is clayish and muddy and the water is, therefore, usually turbid due to the action of the propellers of boats that ply in this area. The water is also polluted with oil from their engines. Despite these drawbacks, this site was selected as *Limnoria* is found to occur in large numbers only in this locality. Attempts to collect them from other places along Bombay coast were not successful.

Untreated timber panels (0) of 30.5 cm. × 3.8 cm. × 3.8 cm. size were immersed together with panels treated with creosote and Ascu, both in two absorptions, 10 lb. (C₁) and 20 lb. (C₂) per cu. ft. in the case of the former and 1 lb. (A₁) and 2 lb. (A₂) per cu. ft. in the case of the latter, so as to find out their efficacy to prevent borer attack. For each treatment, panels in triplicate were kept (Panels A, B & C). The timber panels were procured from various States and in some cases panels of the same species, obtained from different States, were also tested. The panels were periodically examined and the number of *Limnoria* tunnels were counted and recorded.

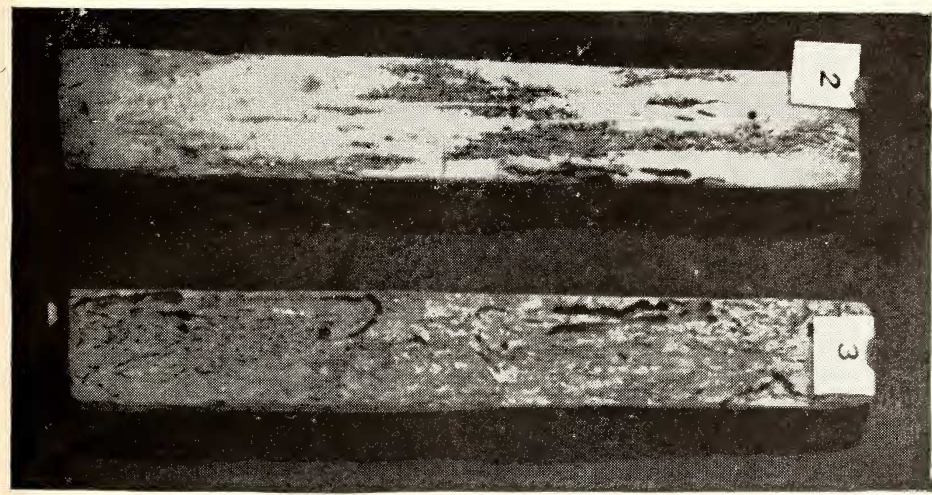
RESULTS

Tables 1 and 2 show the incidence of *Limnoria* on the various species of timber tested. The following list gives the affected species of timber arranged in the order of increasing preference on the basis of the degree of attack on untreated controls at the final inspection.

A. Durability Test Series I (Period of immersion—14 months).

- (1) *Bombax ceiba*
- (2) *Cryptomeria japonica*
- (3) *Cedrus deodara*
- (4) *Dysoxylum malabaricum*
- (5) *Picea smithiana*
- (6) *Pinus wallichiana*
- (7) *Abies pindrow*

Santhakumaran: *Limnoria bombayensis*.



Above: Panels showing heavy attack of *Limnoria bombayensis* after immersion for 18 months. 1 & 2. *Pinus longifolia*; 3. *Alstonia kurzii*; Below: 2. *Pinus longifolia* after immersion for 6½ months; 3. *Bombax insigne* after immersion for 18 months.

B. Durability Test Series II (Period of immersion—18 months).

- (1) *Shorea robusta* (West Bengal).
- (2) *Shorea robusta* (Bihar).
- (3) *Terminalia paniculata*.
- (4) *Tetrameles nudiflora*.
- (5) *Tectona grandis* (Madras).
- (6) *Albizzia* spp.
- (7) *Polyalthia fragrans*.
- (8) *Salmalia insignis*.
- (9) *Alstonia kurzii*.
- (10) *Pinus roxburghii*.

The results also show that *Artocarpus hirsuta*, *Broguira* spp. *Terminalia alata* var. *nepalensis*, *Anogeissus latifolia*, *Shorea robusta* (Assam), *Terminalia arjuna*, *Mangifera indica* and *Tectona grandis* (Bombay) belonging to the Series I, and *Dipterocarpus indicus*, *Xylia xylocarpa*, *Pterocarpus dalbergioides*, *Shorea robusta* (Uttar Pradesh) and *Tectona grandis* (Andhra) belonging to the Series II, have considerable resistance to *Limnoria*, even after a period of 14 to 18 months.

In test I, only panels of group C were available for inspection at the end of 14 months. In this there was no attack on the treated panels, except the Ascu treated (1 lb./cu. ft.) panel of *Bombax ceiba* and creosote treated (10 lb./cu. ft.) panel of *Picea smithiana*.

From Table 2, it can be seen that the two preservatives, Ascu and Creosote, gave complete protection against *Limnoria* upto a period of 10 months (except in the case of *Alstonia kurzii* treated with Ascu at 1 lb./cu. ft.), after which they were no longer capable of preventing the attack of *Limnoria*. It is also found that Creosote treated panels were significantly less attacked than the Ascu treated ones. This may be due to the comparatively higher degree of leachability of Ascu, which is more water soluble than Creosote.

In the untreated condition the coniferous varieties tested are easily attacked by *Limnoria*. Becker (1959), also collected his specimens from Madras coast from panels of *Pinus roxburghii*, *Bombax ceiba* and *Cryptomeria japonica*. It is interesting to note that *Dysoxylum malabaricum*, a species included in the class I grade after grave yard tests at Forest Research Institute and Colleges, Dehra Dun, (average life 180 months and above) has very little resistance to marine borers and suffers heavy attack by *Limnoria* within 8 months of immersion. *Cedrus deodara* and *Tectona grandis*, included in class II grade after land tests (average life 120 to 179 months), though not heavily attacked, are susceptible to marine borers within 2 and 6½ months, respectively,

of immersion. As can be seen from Table 2, only *Tectona grandis* procured from Madras indicated mild attack by *Limnoria* and those obtained from Andhra and Bombay remained unattacked.

CONCLUSIONS AND SUMMARY

1. Results on the relative susceptibility of 25 species of timber, commonly used in marine constructions to the attack of *Limnoria bombavensis* in Bombay waters indicate that most of them do not have any natural resistance and hence should be used only after proper preservative treatment.

2. According to Edmondson (1955:72), the natural durability of timber is not a family or generic character, but clearly specific. This is supported by the present observation on *Salmalia insignis* and *Bombax ceiba*. *Salmalia insignis* shows *Limnoria* incidence within 6½ months of immersion and is heavily attacked within 18 months, while *Bombax ceiba* did not show any sign of incidence after 8 months and was only mildly attacked after 14 months.

3. Silica content of teak varies considerably in different samples, being practically absent in some (Edmondson 1955:67). The durability of woods is often correlated with a high silica content (Gonggrijp 1932; Bianchi 1934) and inconsistencies in the performance of samples from the same species of timber is usually explained as due to variations in the silica content. However, recent studies on the extractives of teak wood (Sandermann & Simatupang 1966) revealed that a compound namely Tectochinon is the agent responsible for the natural resistance of teak. Nevertheless, the slight difference noticed in the response of teak samples procured from Madras, Andhra and Bombay is difficult to explain, as the resistant factors in them are not yet studied in any detail.

4. The coniferous timber, in general, lacked resistance to *Limnoria*. This is in close agreement with the results obtained by Edmondson (1955:53), who after testing various species of *Pinus* from the United States, found that all were heavily attacked by *Teredo* and *Limnoria* after submergence for two or three years. In the present study, the attack was much more severe and the whole surface of some of the panels was riddled by *Limnoria* to a depth of 1 cm. within a period of six to eight months. It is to be noted in this connection that marine borer activity is far more severe in the tropical waters than in the temperate regions.

5. Heart-wood of *Cryptomeria japonica* was heavily attacked by *Limnoria* within 14 months. In Hawaiian waters only slight attack was noted after ten months (Edmondson 1955:63).

TABLE 1

THE INCIDENCE OF *Limnoria* (*Limnoria*) *bombayensis* (PILLAI) ON UNTREATED PANELS OF DURABILITY TEST SERIES I AFTER 14 MONTHS IMMERSION

| Timber species | Locality | Panels | No. of <i>Limnoria</i> tunnels after immersion for | | | |
|---|---------------|--------|--|----------|----------|-----------|
| | | | 2 months | 6 months | 8 months | 14 months |
| Conniferae | | | | | | |
| <i>Abies pindrow</i> (Fir) | Punjab | A | .. | 100 | N | |
| | | B | 9 | 38 | N | |
| | | C | 3 | 38 | N | N |
| <i>Picea smithiana</i> (Spruce) | Kashmir | A | .. | 51 | 127 | |
| | | B | 38 | 97 | N | |
| | | C | .. | 14 | 152 | N |
| <i>Cedrus deodara</i> (Deodar) | Kashmir | A | .. | .. | .. | |
| | | B | 1 | 3 | 38 | |
| | | C | 4 | 48 | 153 | N |
| <i>Pinus wallichiana</i> (Kail) | Uttar Pradesh | A | 9 | 65 | 157 | |
| | | B | 27 | 36 | N | |
| | | C | 4 | 37 | 124 | N |
| Taxodiaceae | | | | | | |
| <i>Cryptomeria japonica</i> (Suji) | | A | .. | .. | 1 | |
| | | B | .. | .. | 29 | |
| | | C | 2 | 2 | 24 | N |
| Meliaceae | | | | | | |
| <i>Dysoxylum malabaricum</i> (White Cedar) | Coorg | A | .. | 3 | N | |
| | | B | .. | .. | missing | |
| | | C | .. | .. | missing | |
| Bombacaceae | | | | | | |
| <i>Bombax ceiba</i> (Semul) | Kutch | A | .. | .. | .. | |
| | | B | .. | .. | .. | |
| | | C | .. | .. | .. | 50 |
| Rhizophoraceae | | | | | | |
| <i>Broguira</i> spp. | Andamans | A | | | | |
| | | B | | | | |
| | | C | | | | |
| Combretaceae | | | | | | |
| <i>Terminalia alata</i> var. <i>nepalensis</i> (Laurel) | Andhra | A | | | | |
| | | B | | | | |
| | | C | | | | |
| <i>Terminalia arjuna</i> (Arjun) | Bihar | A | | | | |
| | | B | | | | |
| | | C | | | | |
| <i>Anogeissus latifolia</i> (Axle-wood) | Andhra | A | | | | |
| | | B | | | | |
| | | C | | | | |
| Moraceae | | | | | | |
| <i>Artocarpus hirsuta</i> (Anjali) | Coorg | A | — No attack — | | | |
| | | B | — No attack — | | | |
| | | C | — No attack — | | | |
| Dipterocarpaceae | | | | | | |
| <i>Shorea robusta</i> (Sal) | Assam | A | | | | |
| | | B | | | | |
| | | C | | | | |
| Anacardiaceae | | | | | | |
| <i>Mangifera indica</i> (Mango) | Orissa | A | | | | |
| | | B | | | | |
| | | C | | | | |
| Verbenaceae | | | | | | |
| <i>Tectona grandis</i> (Teak) | Bombay | A | | | | |
| | | B | | | | |
| | | C | | | | |

